I claim:

1. A method of selectively amplifying nucleic acid sequences related to one or more target sequences, the method comprising,

(a) mixing one or more different open circle probes with a target sample, to produce an OCP-target sample mixture, and incubating the OCP-target sample mixture under conditions that promote hybridization between the open circle probes and the target sequences in the OCP-target sample mixture,

(b) mixing ligase with the OCP-target sample mixture, to produce a ligation mixture, and incubating the ligation mixture under conditions that promote ligation of the open circle probes to form amplification target circles,

(c) mixing a rolling circle replication primer with the ligation mixture, to produce a primer-ATC mixture, and incubating the primer-ATC mixture under conditions that promote hybridization between the amplification target circles and the rolling circle replication primer in the primer-ATC mixture, and

(d) mixing DNA polymerase with the primer-ATC mixture, to produce a polymerase-ATC mixture, and incubating the polymerase-ATC mixture under conditions that promote replication of the amplification target circles,

wherein replication of the amplification target circle results in the formation of tandem sequence DNA.

2. The method of claim 1 further comprising, following step (d),

(e) detecting the presence of tandem sequence DNA.

3. The method of claim 1 further comprising, following step (d),

(e) measuring the amount of tandem sequence DNA formed.

4. The method of claim 1 further comprising, simultaneous with, or following, step (d),

(e) mixing RNA polymerase with the polymerase-ATC mixture, and incubating the polymerase-ATC mixture under conditions that promote transcription of the tandem sequence DNA,

wherein transcription of the tandem sequence DNA results in the formation of tandem sequence RNA.

5. The method of claim 4 further comprising, following step (e),

(f) detecting the presence of tandem sequence RNA.

6. The method of claim 4 further comprising, following step (e),

(f) measuring the amount of tandem sequence RNA formed.

7. The method of claim 1 further comprising, simultaneous with, or following, step (d),

(e) mixing a secondary DNA strand displacement primer with the polymerase-ATC mixture, and incubating the polymerase-ATC mixture under conditions that promote hybridization between the tandem sequence DNA and the secondary DNA strand displacement primer, and replication of the tandem sequence DNA in the polymerase-ATC mixture,

wherein replication of the tandem sequence DNA results in the formation of secondary tandem sequence DNA.

8. The method of claim 7 further comprising, simultaneous with step (e), mixing a tertiary DNA strand displacement primer with the polymerase-ATC mixture.

9. The method of claim 1 wherein at least one of the target sequences comprises a primary amplification target circle, wherein the primary amplification target circle is formed by

(a) mixing a primary open circle probe with a primary target sample, to produce a primary OCP-target sample mixture, and incubating the primary OCP-target sample mixture under conditions that promote hybridization between the primary open circle probe and a primary target sequence in the primary OCP-target sample mixture,

wherein the primary target sequence comprises a 5' region and a 3' region, and

wherein the primary open circle probe comprises a single-stranded, linear DNA molecule comprising, from 5' end to 3' end, a 5' phosphate group, a right target probe portion, a spacer portion, a left target probe portion, and a 3' hydroxyl group, wherein the left target probe portion is complementary to the 3' region of the primary target sequence and the right target probe portion is complementary to the 5' region of the primary target sequence,

(b) mixing ligase with the primary OCP-target sample mixture, to produce a primary ligation mixture, and incubating the primary ligation mixture under conditions that promote ligation of the primary open circle probe resulting in the formation of the primary amplification target circle.

10. The method of claim 1 wherein at least one of the target sequences is part of a reporter binding agent.

11. The method of claim 10 wherein the reporter binding agent comprises an amplification target circle.

12. The method of claim 1 wherein the target sequences each comprise a 5' region and a 3' region, and

wherein the open circle probes each comprise a single-stranded, linear DNA molecule comprising, from 5' end to 3' end, a 5' phosphate group, a right target probe portion, a spacer portion, a left target probe portion, and a 3' hydroxyl group, wherein the spacer portion comprises a primer complement portion, and wherein the left target probe portion and the right target probe portion of the same open circle probe are each complementary to 3' region and the 5' region, respectively, of the same target sequence.

13. The method of claim 12 wherein at least one of the target sequences further comprises a central region located between the 5' region and the 3' region,

wherein neither the left target probe portion of the open circle probe nor the right target probe portion of any of the open circle probes is complementary to the central region of the target sequences, and

wherein step (a) further comprises, prior to incubating, mixing one or more gap oligonucleotides with the target sample, such that the OCP-target sample mixture comprises the one or more open circle probes, the one or more gap oligonucleotides, and the target sample, wherein each gap oligonucleotide comprises a single-stranded, linear DNA molecule comprising a 5' phosphate group and a 3' hydroxyl group, wherein each gap oligonucleotide is complementary all or a portion of the central region of at least one of the target sequences.

14. The method of claim 12 wherein at least one of the target sequences further comprises a central region located between the 5' region and the 3' region,

wherein neither the left target probe portion of the open circle probe nor the right target probe portion of any of the open circle probes is complementary to the central region of the target sequences, and

wherein step (b) further comprises, prior to incubating, mixing gap-filling DNA polymerase with the OCP-target sample mixture.

15. A method of amplifying nucleic acid sequences, the method comprising,

(a) mixing a rolling circle replication primer with one or more amplification target circles, to produce a primer-ATC mixture, and incubating the primer-ATC mixture under conditions that promote hybridization between the amplification target circles and the rolling circle replication primer in the primer-ATC mixture,

wherein the amplification target circles each comprise a single-stranded, circular DNA molecule comprising a primer complement portion, wherein the primer complement portion is complementary to the rolling circle replication primer,

(b) mixing DNA polymerase with the primer-ATC mixture, to produce a polymerase-ATC mixture, and incubating the polymerase-ATC mixture under conditions that promote replication of the amplification target circles,

wherein replication of the amplification target circles results in the formation of tandem sequence DNA, and

wherein an amplification operation is performed simultaneous with, or following, step (b), wherein the amplification operation is selected from the group consisting of secondary ligation mediated rolling circle amplification, secondary DNA strand displacement, and transcription.

16. The method of claim 15 further comprising, following the amplification operation, detecting the presence of tandem sequence DNA.

17. The method of claim 15 further comprising, following the amplification operation, measuring the amount of tandem sequence DNA formed.

18. The method of claim 15 wherein the amplification operation comprises, simultaneous with, or following, step (b),

(c) mixing RNA polymerase with the polymerase-ATC mixture, and incubating the polymerase-ATC mixture under conditions that promote transcription of the tandem sequence DNA,

wherein transcription of the tandem sequence DNA results in the formation of tandem sequence RNA.

19. The method of claim 18 further comprising, following step (c),

(d) detecting the presence of tandem sequence RNA.

20. The method of claim 18 further comprising, following step (c),

(d) measuring the amount of tandem sequence RNA formed.

21. The method of claim 15 wherein the amplification operation comprises, simultaneous with, or following, step (b).

(c) mixing a secondary DNA strand displacement primer with the polymerase-ATC mixture, and incubating the polymerase-ATC mixture under conditions that promote hybridization between the tandem sequence DNA and the

secondary DNA strand displacement primer, and replication of the tandem sequence DNA in the polymerase-ATC mixture,

wherein replication of the tandem sequence DNA results in the formation of secondary tandem sequence DNA.

22. The method of claim 21 further comprising, simultaneous with step (c), mixing a tertiary DNA strand displacement primer with the polymerase-ATC mixture.

23. The method of claim 15 wherein at least one of the amplification target circles is tethered to a specific binding molecule.

24. A method of amplifying nucleic acid sequences, the method comprising,

(a) mixing a rolling circle replication primer with one or more amplification target circles, to produce a primer-ATC mixture, and incubating the primer-ATC mixture under conditions that promote hybridization between the amplification target circles and the rolling circle replication primer in the primer-ATC mixture,

wherein the amplification target circles each comprise a single-stranded, circular DNA molecule comprising a primer complement portion, and wherein the primer complement portion is complementary to the rolling circle replication primer, and

wherein at least one of the amplification target circles is tethered to a specific binding molecule, and

(b) mixing DNA polymerase with the primer-ATC mixture, to produce a polymerase-ATC mixture, and incubating the polymerase-ATC mixture under conditions that promote replication of the amplification target circles,

wherein replication of the amplification target circles results in the formation of tandem sequence DNA.

25. The method of claim 24 further comprising, following step (b),

(c) detecting the presence of tandem sequence DNA.

26. The method of claim 24 further comprising, following step (b),

(c) measuring the amount of tandem sequence DNA formed.

27. The method of claim 24 further comprising, simultaneous with, or following, step (b),

(c) mixing RNA polymerase with the polymerase-ATC mixture, and incubating the polymerase-ATC mixture under conditions that promote transcription of the tandem sequence DNA,

wherein transcription of the tandem sequence DNA results in the formation of tandem sequence RNA.

28. The method of claim 27 further comprising, following step (c),

(d) detecting the presence of tandem sequence RNA.

29. The method of claim 27 further comprising, following step (c),

(d) measuring the amount of tandem sequence RNA formed.

30. The method of claim 24 further comprising, simultaneous with, or following, step (b),

(c) mixing a secondary DNA strand displacement primer with the polymerase-ATC mixture, and incubating the polymerase-ATC mixture under conditions that promote hybridization between the tandem sequence DNA and the secondary DNA strand displacement primer, and replication of the tandem sequence DNA in the polymerase-ATC mixture,

wherein replication of the tandem sequence DNA results in the formation of secondary tandem sequence DNA.

31. The method of claim 30 further comprising, simultaneous with step (b), mixing a tertiary DNA strand displacement primer with the polymerase-ATC mixture.

32. An open circle probe specific for a target sequence, wherein the target sequence comprises a 5' region and a 3' region, the open circle probe comprising a single-stranded, linear DNA molecule comprising, from 5' end to 3'

end, a 5' phosphate group, a right target probe portion, a spacer portion, a left target probe portion, and a 3' hydroxyl group,

wherein the spacer portion comprises a primer complement portion, and

wherein the left target probe portion is complementary to the 3' region of the target sequence and the right target probe portion is complementary to the 5' region of the target sequence.

33. The open circle probe of claim 32 wherein the spacer portion comprises a promoter portion wherein the promoter portion comprises a promoter sequence.

34. The open circle probe of claim 32 wherein the spacer portion comprises one or more detection tag portions wherein the detection tag portions each comprise a sequence complementary to a detection probe.

35. The open circle probe of claim 32 wherein the spacer portion comprises one or more secondary target sequence portions wherein the secondary target sequence portions each comprise a sequence complementary to target probe portions of a secondary open circle probe.

36. The open circle probe of claim 32 wherein the spacer portion comprises an address tag portion.

37. The open circle probe of claim 32 wherein the target sequence further comprises a central region located between the 5' region and the 3' region,

wherein neither the left target probe portion of the open circle probe nor the right target probe portion of the open circle probe is complementary to a central region of the target sequence.

38. A kit for selectively amplifying nucleic acid sequences related to one or more target sequences, each comprising a 5' region and a 3' region, the kit comprising,

(a) one or more open circle probes each comprising a single-stranded, linear DNA molecule comprising, from 5' end to 3' end, a 5' phosphate group, a

right target probe portion, a spacer portion, a left target probe portion, and a 3' hydroxyl group,

wherein the spacer portion comprises a primer complement portion, and

wherein the left target probe portion is complementary to the 3' region of at least one of the target sequences and the right target probe portion is complementary to the 5' region of the same target sequence, and

(b) a rolling circle replication primer comprising a single-stranded, linear nucleic acid molecule comprising a complementary portion that is complementary to the primer complement portion of one or more of the open circle probes.

39. The kit of claim 38 further comprising a secondary DNA strand displacement primer comprising a single-stranded, linear nucleic acid molecule comprising a matching portion that matches a portion of one or more of the open circle probes.

40. The kit of claim 38 further comprising one or more reporter antibodies each comprising an antibody portion and an oligonucleotide portion, wherein the oligonucleotide portion comprises one of the target sequences.

41. A kit for selectively detecting a target molecule, the kit comprising,

(a) one or more amplification target circles,

wherein the amplification target circle comprises a single-stranded, circular DNA molecule comprising a primer complement portion, wherein each amplification target circle is tethered to a specific binding molecule, and

(b) a rolling circle replication primer comprising a single-stranded, linear nucleic acid molecule comprising a complementary portion that is complementary to the primer complement portion of one or more of the amplification target circles.

42. The kit of claim 41 further comprising a secondary DNA strand displacement primer comprising a single-stranded, linear nucleic acid molecule

comprising a matching portion that matches a portion of one or more of the amplification target circles.